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NAVAL POSTGRADUATE SCHOOL

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INTEGRATION OF A HIGH ENERGY LASER INTO THE VIRGINIA CLASS SUBMARINE

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Background: The Division of Undersea Warfare (OPNAV N97) wants to investigate the feasibility of installing a HEL system on Virginia Class Submarine (VCS) BLK V platforms and beyond. One of the primary challenges of VCS HEL implementation is working within the confines of the VCS physical architecture. Other challenges common to all maritime platforms are mitigating the effect of the ambient environment including sea state, atmospheric optical turbulence and atmospheric transmission. In addition, the system will require innovative design and implementation to operate effectively with other combat systems while also being properly integrated with other submarine systems. A key requirement will be the ability for the system to engage threats from the surface.

Process and Research Objectives

- Define the mission through user input, context definition, identification of constraints including propagation effects (e.g. atmospheric optical turbulence), concept of operations and scenario generation.
- Analyze the mission through mission functional/timeline analyses, generating a design reference mission, operations analyses and performance requirements definition.
- Establish or validate system level requirements through system functional and timeline analyses including functional allocation.
- Synthesize concepts by identifying alternatives, assessing technology, generation of schematic block diagrams and selection of major alternative system suites.
- Evaluate concepts through selection of measures of performance/effectiveness, trade studies, performance analyses, cost-effectiveness analyses and selection of preferred alternatives.
- Refine the concept architecture, integration concept, preliminary system layout and concept of operations with documentation of decisions.

Findings and Conclusions: The SE team conducted an IPR with N97 Sponsors on 13 April 2015. The HELSUB Team of Distance Learning cohorts 311-124O, 311-124G and 311-133O completed a Capstone on Integration of a High Energy Laser into a Future Class of Submarine. This project included combat systems activities at a top level through concept synthesis with three candidate concepts for integration. LT Patrick Stone is beginning a more detailed mission definition and analysis having just received approval on his thesis proposal. Measurements of atmospheric optical turbulence over Lazer Bay on San Nicolas Island are ongoing with plans for measurements at lower heights.

Recommendations: More detailed study of candidate concepts is required upon completion of the LT Stone's thesis work - coordinating with N97 for LT Stone's stakeholder discussions. In addition, refinements based on context information derived from improved propagation measurements will affect follow on synthesis.